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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Robert D. Barnes et al.	§		
	§	Group Art Unit:	2625
Serial No.: 09/716,603	§		
	§	Examiner:	Johnson, Timothy M.
Filed: November 20, 2000	§		
	§		
For: METHOD AND SYSTEM FOR LOSSLESS WAVELET DECOMPOSITION, COMPRESSION AND DECOMPRESSION OF DATA	§	Atty. Docket:	GEMS:0131/YOD 15-IS-5887

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11/9/04 Brent R Knight

Date Brent R. Knight

APPEAL BRIEF PURSUANT TO 37 C.F.R. §§ 1.191 AND 1.192

This Appeal Brief is being filed in furtherance to the Notice of Appeal mailed on August 5, 2004, and received by the Patent Office on August 9, 2004.

1. REAL PARTY IN INTEREST

The real party in interest is GE Medical Systems Information Technologies, Inc., the Assignee of the above-referenced application by virtue of the Assignment recorded at reel 011340, frame 0015 on November 20, 2000. The Assignee of the above-referenced application, as evidenced by the documents mentioned above, will be directly affected by the Board's decision in the pending appeal.

2. RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellants' legal representative in this Appeal.

3. STATUS OF CLAIMS

Claims 2-55 are currently pending, under final rejection, and, thus, are the subject of this appeal.

4. STATUS OF AMENDMENTS

Appellants have not submitted any amendments subsequent to the Final Office Action mailed on May 5, 2004.

5. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention relates generally to the field of image compression and decompression. *See* Application, page 1, lines 8-9. More particularly, the present invention relates to a technique for rapidly compressing image data for efficient transmission and decompression. *See id.* at page 1, lines 9-10.

In the medical field, large image files are typically created during an image acquisition and encoding sequence, such as in an x-ray system, a magnetic resonance imaging system, a computed tomography imaging system, and so forth. *See id.* at page 2, lines 21-30. The image files may be stored in raw and processed formats, which consume considerable amounts of memory space. *See id.* at page 3, lines 1-5. Because these image files are large, it can be difficult or time consuming to transmit the image files from one location to another. *See id.* at page 3, lines 7-15. However, a technique had not been developed prior to the present technique to provide rapid compression of the image data, particularly in medical diagnostics applications. *See id.* at page 3, line 18 – page 4, line 13.

Appellants provide a technique that utilizes image data compression designed to respond to those needs. Specifically, the technique provides lossless integer wavelet decomposition of image data, which is followed by lossless compression of the data sets. *See id.* at page 4, lines 16-29. In one aspect, multiresolution image compression allows a

user to view a reduced size or reduced resolution image relatively rapidly, and to "zoom" on the image thereafter by transfer of only a portion of the compressed data corresponding to components of the greater sized resolution image not already transferred. *See id.* at Fig. 14; page 24, line 30 – page 25, line 2. The present multiresolution implementation is based upon lossless wavelet decomposition in combination with optimized lossless compression, and may include modification of the lossless compression based on recognition of the nature of high frequency data sets from the wavelet decomposition. *See id.* at page 25, lines 6-10. The wavelet decomposition, which may involve dyadic filtering and sub-sampling, creates a hierarchical set of sub-bands. *See id.* at Fig. 14; page 25, lines 10-22. The data sets obtained by successive wavelet decomposition are then compressed. *See id.* at Fig. 15; page 28, line 29-page 29, line 11. The high frequency data sets may be compressed in accordance with a modified compression routine. *See id.* at page 29, lines 13-24. Because the low frequency data sets for each higher level are further decomposed, this data set may be compressed in accordance with a predictive error compression technique. *See id.* at page 29, lines 26-31.

With regard to the exemplary embodiment described in independent claim 2, discussions about the recited features of claim 2 can be found at least in the below cited locations of the specification and drawings. An embodiment in accordance with the present invention relates to a method of compressing image data (e.g., 300). *See, e.g.*, Application, page 4, lines 16-29. The method includes the act of decomposing the image data (e.g., 300) into a plurality of data sets (e.g., 306, 316, 330, 332, 334, 336) using lossless wavelet decomposition. *See, e.g.*, Application; Figs. 14-17, page 25, line 6 to page 32, line 25. Also, the method includes compressing the plurality of data sets (e.g., 306, 316, 330, 332, 334, 336) using lossless compression. *See id.* Further, the method includes compiling a data stream (e.g., 342) comprising the compressed plurality of data sets (e.g., 346, 348) arranged sequentially in a desired order based upon the decomposition. *See id.*

With regard to the exemplary embodiment described in independent claim 13, discussions about the recited features of claim 13 can be found at least in the below cited locations of the specification and drawings. An embodiment in accordance with the present invention relates to a method for retrieving compressed image data (e.g., 194). *See, e.g.*, Application, page 4, lines 16-29. The method includes determining a parameter (e.g., 174) of a user view port. *See* Application, Figs. 7 and 13, page 14, line 25 to page 15, line 17; page 23, line 10 to page 25, line 5. Further, the claim also recites selectively transmitting a portion of compressed image data (e.g., 200) based upon the parameter (e.g., 174), wherein the compressed image data (e.g., 200) comprises a series of compressed data sets (e.g., 346, 348) generated by lossless wavelet decomposition and compression, and wherein the series is ordered sequentially based upon order of generation of the data sets (e.g., 306, 316, 330, 332, 334, 336) during lossless wavelet decomposition. *See, e.g.*, Application; Figs. 13-17, page 23, line 1 to page 32, line 25.

With regard to the exemplary embodiment described in independent claim 22, discussions about the recited features of claim 22 can be found at least in the below cited locations of the specification and drawings. An embodiment in accordance with the present invention relates to a method for handling image data (e.g., 300). *See, e.g.*, Application, page 4, lines 16-29. The method includes the act of decomposing the image data (e.g., 300) into a plurality of resolution levels using lossless wavelet decomposition. *See, e.g.*, Application; Figs. 14-17, page 25, line 6 to page 32, line 25. Also, the method includes compressing the decomposed image data from each resolution level using lossless compression. *See id.* Further, the method includes creating and storing a data stream (e.g., 342) in sets based upon the resolution levels of decomposed and compressed image data. *See id.*

With regard to the exemplary embodiment described in independent claim 30, discussions about the recited features of claim 30 can be found at least in the below cited locations of the specification and drawings. An embodiment in accordance with the

present invention relates to a method of storing image data (e.g., 300). *See, e.g.*, Application, page 4, lines 16-29. The method includes decomposing the image data (e.g., 300) into a plurality of resolution levels using lossless integer wavelet decomposition. *See, e.g.*, Application; Figs. 14-17, page 25, line 6 to page 32, line 25. Further, the claim also recites compressing the decomposed image data based upon the plurality of resolution levels. *See id.* Then, the method includes composing a file (e.g., 342) such that the decomposed and compressed image data is ordered sequentially by resolution level in order of increasing resolution. *See id.* Finally, the method includes storing the file (e.g., 342). *See id.*

With regard to the exemplary embodiment described in independent claim 36, discussions about the recited features of claim 36 can be found at least in the below cited locations of the specification and drawings. An embodiment in accordance with the present invention relates to a system that includes a compression interface (e.g., 20) and a memory device. *See, e.g.*, Fig.1, Application, page 4, lines 16-29; page 6, line 30 to page 9, line 2. The compression interface (e.g., 20) configured to decompose image data (e.g., 300) using lossless wavelet decomposition producing a plurality of data sets (e.g., 306, 316, 330, 332, 334, 336) corresponding to a plurality of resolution levels comprising a lowest resolution level and a highest resolution level, being configured to losslessly compress the plurality of data sets (e.g., 306, 316, 330, 332, 334, 336), and being configured to arrange the compressed plurality of data sets (e.g., 306, 316, 330, 332, 334, 336) into a data stream (e.g., 342) in order of increasing resolution from the lowest resolution level to the highest resolution level. *See, e.g.*, Application; Figs. 1 and 14-17, page 6, line 30 to page 9, line 2; page 25, line 6 to page 32, line 25. Further, the memory device is configured to store the data stream (e.g., 342). *See id.*

With regard to the exemplary embodiment described in independent claim 49, discussions about the recited features of claim 49 can be found at least in the

below cited locations of the specification and drawings. An embodiment in accordance with the present invention relates to a computer program including configuration code stored on the machine readable medium. *See, e.g.*, Application, page 4, lines 16-29. The configuration code is configured to generate a plurality of data sets (e.g., 306, 316, 330, 332, 334, 336) by decomposing image data (e.g., 300) using lossless wavelet decomposition, each data set (e.g., 306, 316, 330, 332, 334, 336) corresponding to a resolution level, the code being further configured to losslessly compress the plurality of data sets (e.g., 306, 316, 330, 332, 334, 336) and arrange the compressed plurality of data sets (e.g., 346, 348) in order of increasing resolution. *See, e.g.*, Application; Figs. 14-17, page 25, line 6 to page 32, line 25.

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

First Ground of Rejection for Review on Appeal:

Appellants respectfully urge the Board to review and reverse the Examiner's first ground of rejection in which the Examiner rejected claims 2-9, 11, 13-24, 27-32, 34-36, 45-46, 48-52 and 54-55 under 35 U.S.C. § 103(a) as being rendered obvious by U.S. Patent No. 6,091,777 to Guetz et al. ("the Guetz reference") in view of U.S. Patent No. 5,867,602 to Zandi et al. ("the Zandi reference").

Second Ground of Rejection for Review on Appeal:

Appellant respectfully urges the Board to review and reverse the Examiner's second ground of rejection in which the Examiner rejected claims 10, 25, 33, 47 and 53 under 35 U.S.C. § 103(a) as being rendered obvious by Guetz in view of Zandi and U.S. Patent No. 6,445,823 to Liang ("the Liang reference").

Third Ground of Rejection for Review on Appeal:

Appellants respectfully urge the Board to review and reverse the Examiner's third ground of rejection in which the Examiner rejected claims 12 and 26 under 35 U.S.C. §

103(a) as being rendered obvious by Guetz in view of Zandi and U.S. Patent Application No. 2002/0003906 to Zeng ("the Zeng reference").

Fourth Ground of Rejection for Review on Appeal:

Appellants respectfully urge the Board to review and reverse the Examiner's fourth ground of rejection in which the Examiner rejected claims 37-44 under 35 U.S.C. § 103(a) as being rendered obvious over Guetz in view of Zandi and U.S. Patent No. 6,574,629 to Cooke, Jr. et al. ("the Cooke reference").

7. ARGUMENT

As discussed in detail below, the Examiner has improperly rejected the pending claims. Further, the Examiner has misapplied long-standing and binding legal precedents and principles in rejecting the claims under Section 103. Accordingly, Appellants respectfully request full and favorable consideration by the Board, as Appellants strongly believe that claims 2-55 are currently in condition for allowance.

A. Ground of Rejection No. 1:

The Examiner rejected claims 2-9, 11, 13-24, 27-32, 34-36, 45-46, 48-52 and 54-55 under 35 U.S.C. § 103(a) as being unpatentable over the Guetz reference in view of the Zandi reference. While the Examiner rejected each of the independent claims 2, 13, 22, 30, 36 and 49 under the same proposed combination of prior art, each of these independent claims will be discussed separately below. Accordingly, Appellants respectfully traverse this rejection.

1. Legal Precedent and Standard for a *Prima Facie* Obviousness Rejection.

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (B.P.A.I. 1979). Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention absent some teaching or suggestion supporting the combination. *ACS Hospital Systems, Inc.*

v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984). Accordingly, to establish a *prima facie* case, the Examiner must not only show that the combination includes all of the claimed elements, but also a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). When prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988).

Furthermore, a *prima facie* case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. *In re Geisler*, 116 F.3d 1465, 1471, 43 U.S.P.Q.2d 1362, 1366 (Fed. Cir. 1997). In fact, teaching away from the art is a *per se* demonstration of lack of *prima facie* obviousness. *In re Dow Chemical Co.*, 837 F.2d 469, 5 U.S.P.Q.2d 1529 (Fed. Cir. 1988). Accordingly, it is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 U.S.P.Q. 769, 779 (Fed. Cir. 1983); M.P.E.P. § 2145. Furthermore, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (C.C.P.A. 1959); *See* M.P.E.P. § 2143.01.

2. **Quantization is a Lossy Process.**

As a preliminary matter, Appellants would like to note that the use of quantization is not lossless compression. The use of quantization clearly compresses the image by reducing the bits associated with the image through a many-to-one mapping. Once quantized, the image cannot be recreated into the original image because the quantization technique necessarily drops bits from the image data that cannot be recovered. As a

result, one skilled in the art would recognize that quantization of an image results in *lossy compression.* Accordingly, in so much as the references relied upon by the Examiner employ quantization of image data, the reference teaches a lossy compression process and not a lossless process as claimed. As a result of the inherent nature of quantization, any reference that teaches any step of compression based on quantization *cannot* qualify as teaching lossless compression.

3. <u>Claim 2 is Patentable over Guetz and Zandi.</u>

Independent claim 2 recites:

> A method for compressing image data, the method comprising the acts of:
>
> decomposing the image data into a plurality of data sets using lossless wavelet decomposition;
>
> compressing the plurality of data sets using lossless compression; and
>
> compiling a data stream comprising the compressed plurality of data sets arranged sequentially in a desired order based upon the decomposition.

<u>a. The Examiner's Rejection.</u>

In the rejection of independent claim 2, the Examiner asserted that the Guetz reference discloses all of the recited features except that it does not explicitly provide for lossless wavelet decomposition. *See* Official Action mailed May 5, 2004, p. 2. Specifically, in the Office Action mailed May 5, 2004, the Examiner admitted that the Guetz reference does not explicitly provide for lossless wavelet decomposition. *See id.* Additionally, in the "Response to Arguments" section of the same action, the Examiner again stated that Guetz does not provide lossless decomposition. *See id.* at p. 11. In an attempt to cure this deficiency, the Examiner relied upon the Zandi reference.

Despite the Examiner's assertions, the Guetz and Zandi references are incompatible with each other and fail to render the claimed subject matter obvious. In particular, claim 2 recites that the image data is *decomposed* into "a plurality of data sets using lossless wavelet decomposition," the *plurality of data sets* are *compressed* "using lossless

compression," and the *compressed plurality of data sets* are *compiled* "into a desired order based upon the decomposition." As a result, a process that employs the claimed features produces a lossless data stream. With this in mind, Appellants assert that the Guetz and Zandi references, which are clearly incompatible, fail to render the claimed subject matter obvious. Furthermore, the incompatibilities of the Guetz and Zandi references demonstrate that the Examiner has failed to present a *prima facie* case of obviousness, as addressed below.

b. References are Incompatible because Guetz Teaches Lossy Compression.

The combination of the Guetz reference and Zandi reference is not proper because the references are incompatible. As noted above, the Examiner conceded that the Guetz reference does not explicitly disclose lossless wavelet decomposition. Indeed, the Guetz reference specifically teaches the use of quantization to compress and encode wavelet coefficients, and quantization is a lossy process. In Guetz, compression by quantization is utilized to encode wavelet coefficients that are defined by the location in the frequency band and the importance for the quality of the image. *See* Guetz, col. 9, lines 1-9. The Guetz process utilizes quantization to achieve low distribution and meet a targeted bit rate constraint. *See* Guetz, col. 9, lines 26-32. Because quantization is a lossy process that reduces the bits utilized to represent an image through a many-to-one mapping, the use of quantization as part of the process in Guetz necessarily prevents the original image from being fully reconstructed. Accordingly, those skilled in the art will readily appreciate that quantization processes, as fully acknowledged by Guetz, results in the process being lossy even if lossless compression is utilized after the quantization step. Accordingly, because the Guetz reference clearly teaches a lossy compression process, it fails to disclose lossless process, let alone lossless wavelet decomposition or lossless compression as recited in claim 2.

Contrary to the Guetz reference, the Zandi reference discusses wavelet decomposition, as well as lossy and lossless compression. *See* Zandi, col. 7, lines 3-

5. However, because Guetz teaches exclusively of lossy compression, the Appellants submit that the two references cannot logically be combined. That is, imposing lossless decomposition and compression constraints from Zandi on the necessarily lossy processes taught by Guetz is entirely inconsistent with the teachings of Guetz. Accordingly, the combination proposed by the Examiner is unsupported by and antithetical to the teachings of the references themselves.

Furthermore, the Zandi reference teaches a specific order for processing the data, which is contrary to the Guetz reference and even the features recited in the claims. In particular, Zandi teaches various types of wavelet decomposition followed by assembly of a data or code stream. *See* Zandi, Fig. 1; col. 7, lines 7-19. In Zandi, an ordering/modeling block 103 receives the wavelet coefficients, orders the wavelet coefficients and provides an embedded data stream to an encoder to compress the embedded data stream. *See id.* at col. 7, lines 44-63. That is, the wavelet coefficients are *assembled* into a bit stream and *then* compressed. This order of operations is discussed throughout the Zandi reference. By virtue of this ordering of the steps, the data stream, such as illustrated in Figures 24A and 24B of Zandi, is transmitted and decompressed regardless of the resolution that is desired or useful for the user. *See id.* at Fig. 24A and 24B; col. 31, line 56 – col. 32, line 50. Clearly, the compression after data ordering and modeling, as disclosed in Zandi, is in contrast with the Guetz or even the features recited in the claims, which compile the data stream following compression of the decomposed data sets. As such, the Zandi reference clearly teaches a specific order that is inconsistent with the teachings in the Guetz reference or the claims. Accordingly, the Zandi reference does not cure the deficiencies of the Guetz reference because it is, in fact, incompatible with the Guetz reference.

c. The Examiner's Rational is unsupported by the References.

Moreover, the Examiner's rationale for combining the references appears to be based on potential advantages hypothesized by the Examiner, not on the teachings

in references themselves. Specifically, the Examiner stated that it would have been obvious to a person of ordinary skill in the art at the time of the invention to provide exact reconstruction. However, this statement is an unsupported assertion about the teachings of the references, which is not provided in the references. The Examiner has not provided any evidence of suggestion by the prior art references that the proposed advantages would be expected from the combination. In fact, this statement is in direct conflict with the teachings in the Guetz reference, which clearly teaches lossy compression because it utilizes a quantization step in the compression process. *See* Guetz, col. 9, lines 1-9 and lines 26-32. Thus, the Examiner's rational is inconsistent with the teachings of Guetz. Further, the combination proposed by the Examiner is unsupported by and antithetical to the teachings of the references themselves. Because no teaching or suggestion supporting the combination is present, the Examiner's proposed combination is unsupported speculation and therefore is not proper.

For at least these reasons, the Guetz and Zandi references cannot be properly combined to render the Appellants' claims obvious because the references are incompatible and the Examiner's rationale is unsupported by the references. Accordingly, Appellants request the Board overturn the rejection and allow the rejected claims.

4. <u>Claim 13 and its dependent claims are Patentable over Guetz and Zandi.</u>

Independent claim 13 recites:

> A method for retrieving compressed image data, the method comprising the acts of:
>
> determining a parameter of a user view port;
>
> selectively transmitting a portion of compressed image data based upon the parameter, wherein the compressed image data comprises a series of compressed data sets generated by lossless wavelet decomposition and compression, and wherein the series is ordered sequentially based upon order of generation of the data sets during lossless wavelet decomposition.

In the rejection of independent claim 13, the Examiner relied upon assertions made in relation to independent claim 2 to reject independent claim 13, as noted above. In particular, the Examiner admitted that the Guetz reference does not explicitly provide for lossless wavelet decomposition, as previously discussed. Further, in the "Response to Arguments" section of the same action, the Examiner again stated that Guetz does not provide lossless decomposition. Accordingly, in an attempt to cure this deficiency, the Examiner relied upon the Zandi reference.

However, despite the Examiner's assertions, the Guetz and Zandi references are incompatible with each other and fail to render the claimed subject matter obvious. For instance, claim 13 recites transmitting a portion of compressed image data that comprises "a series of compressed data sets generated by lossless wavelet decomposition and compression" and the "series is ordered sequentially based upon order of generation of the data sets during lossless wavelet decomposition." With this in mind, Appellants assert that the Guetz and Zandi references, which are clearly incompatible, fail to render the claimed subject matter obvious. Furthermore, the incompatibilities of the Guetz and Zandi references demonstrate that the Examiner has failed to present a *prima facie* case of obviousness, as addressed below.

Claim 13 is clearly patentable for the same reasons set forth above with respect to claim 2, and the arguments summarized there are herein incorporated by reference. In short, the Guetz reference clearly teaches the benefits of a lossy process, while Zandi teaches using lossy or lossless process. Further, the Zandi reference teaches a specific order that is inconsistent with the Guetz reference and even the order recited in the claims. As such, the two references cannot logically be combined. Furthermore, the Examiner's proposed combination is unsupported speculation and inconsistent with the teachings of the Guetz reference. Hence, the Guetz and Zandi references, which are clearly incompatible, fail to render the claimed subject matter obvious.

For at least these reasons, the Guetz and Zandi references cannot be properly combined to render the Appellants' claims obvious because the references are incompatible and the Examiner's rationale is unsupported by the references. Accordingly, Appellants request the Board overturn the rejection and allow the rejected claim 13 and its dependent claims.

5. <u>Claim 22 and its dependent claims are Patentable over Guetz and Zandi.</u>

Independent claim 22 recites:

> A method for handling image data, the method comprising the acts of:
> decomposing the image data into a plurality of resolution levels using lossless wavelet decomposition;
> compressing the decomposed image data from each resolution level using lossless compression; and
> creating and storing a data stream in sets based upon the resolution levels of decomposed and compressed image data.

In the rejection of independent claim 22, the Examiner relied upon assertions made in relation to independent claim 2 to formulate the basis of the rejection of independent claim 22. Again, as noted above, the Examiner admitted that the Guetz reference does not explicitly provide for lossless wavelet decomposition. Accordingly, in an attempt to cure this deficiency, the Examiner relied upon the Zandi reference.

However, despite the Examiner's assertions, the Guetz and Zandi references are incompatible with each other and fail to render the claimed subject matter obvious. For instance, claim 22 recites that the image data is *decomposed* into "a plurality of resolution levels using lossless wavelet decomposition," each of the resolution levels are *compressed* "using lossless compression," and "creating and storing a data stream in sets based upon the resolution levels of decomposed and compressed image data." As a result, a lossless data stream is formed. With this in mind, Appellants assert that the Guetz and Zandi references, which are clearly incompatible, fail to render the claimed subject matter

obvious. Furthermore, the incompatibilities of the Guetz and Zandi references demonstrate that the Examiner has failed to present a *prima facie* case of obviousness, as addressed below.

Claim 22 is clearly patentable for the same reasons set forth above with respect to claim 2, and the arguments summarized there are herein incorporated by reference. In short, the Guetz reference clearly teaches the benefits of a lossy process, while Zandi teaches using lossy or lossless process. Further, the Zandi reference teaches a specific order that is inconsistent with the Guetz reference and even the order recited in the claims. As such, the two references cannot logically be combined. Furthermore, the Examiner's proposed combination is unsupported speculation and inconsistent with the teachings of the Guetz reference. Hence, the Guetz and Zandi references, which are clearly incompatible, fail to render the claimed subject matter obvious.

For at least these reasons, the Guetz and Zandi references cannot be properly combined to render the Appellants' claims obvious because the references are incompatible and the Examiner's rationale is unsupported by the references. Accordingly, Appellants request the Board overturn the rejection and allow the rejected claim 22 and its dependent claims.

6. <u>Claim 30 and its dependent claims are Patentable over Guetz and Zandi.</u>

Independent claim 30 recites:

> A method of storing image data, the method comprising the acts of:
>
> decomposing the image data into a plurality of resolution levels using lossless integer wavelet decomposition;
>
> compressing the decomposed image data based upon the plurality of resolution levels;
>
> composing a file such that the decomposed and compressed image data is ordered sequentially by resolution level in order of increasing resolution; and
>
> storing the file.

In the rejection of independent claim 30, the Examiner relied upon assertions made in relation to independent claim 2 to formulate the basis of the rejection of independent claim 30. As previously discussed, the Examiner admitted that the Guetz reference does not explicitly provide for lossless wavelet decomposition. Accordingly, in an attempt to cure this deficiency, the Examiner relied upon the Zandi reference.

However, despite the Examiner's assertions, the Guetz and Zandi references are incompatible with each other and fail to render the claimed subject matter obvious. Specifically, claim 30 recites that the image data is *decomposed* into "a plurality of resolution levels using lossless integer wavelet decomposition," the decomposed image is *compressed* "based upon the plurality of resolution levels" and a file is *composed* from "the decomposed and compressed image data is ordered sequentially by resolution level in order of increasing resolution." With this in mind, Appellants assert that the Guetz and Zandi references, which are clearly incompatible, fail to render the claimed subject matter obvious. Furthermore, the incompatibilities of the Guetz and Zandi references demonstrate that the Examiner has failed to present a *prima facie* case of obviousness, as addressed below.

Claim 30 is clearly patentable for the same reasons set forth above with respect to claim 2, and the arguments summarized there are herein incorporated by reference. In short, the Guetz reference clearly teaches the benefits of a lossy process, while Zandi teaches using lossy or lossless process. Further, the Zandi reference teaches a specific order that is inconsistent with the Guetz reference and even the order recited in the claims. As such, the two references cannot logically be combined. Furthermore, the Examiner's proposed combination is unsupported speculation and inconsistent with the teachings of the Guetz reference. Hence, the Guetz and Zandi references, which are clearly incompatible, fail to render the claimed subject matter obvious.

For at least these reasons, the Guetz and Zandi references cannot be properly combined to render the Appellants' claims obvious because the references are incompatible and the Examiner's rationale is unsupported by the references. Accordingly, Appellants request the Board overturn the rejection and allow the rejected claim 30 and its dependent claims.

7. **Claim 36 and its dependent claims are Patentable over Guetz and Zandi.**

Independent claim 36 recites:

> A system comprising:
> a compression interface, the interface being configured to decompose image data using lossless wavelet decomposition producing a plurality of data sets corresponding to a plurality of resolution levels comprising a lowest resolution level and a highest resolution level, being configured to losslessly compress the plurality of data sets, and being configured to arrange the compressed plurality of data sets into a data stream in order of increasing resolution from the lowest resolution level to the highest resolution level; and
> a memory device configured to store the data stream.

In the rejection of independent claim 36, the Examiner relied upon assertions made in relation to independent claim 2 to formulate the basis of the rejection of independent claim 36. Again, as noted above, the Examiner admitted that the Guetz reference does not explicitly provide for lossless wavelet decomposition. Accordingly, in an attempt to cure this deficiency, the Examiner relied upon the Zandi reference.

However, despite the Examiner's assertions, the Guetz and Zandi references are incompatible with each other and fail to render the claimed subject matter obvious. Specifically, claim 36 recites that the image data is *decomposed* into "a plurality of data sets corresponding to a plurality of resolution levels comprising a lowest resolution level and a highest resolution level," each of the data sets is *losslessly compressed* and the compressed data sets are *arranged* into a data stream. As a result, the lossless data stream is formed. With this in mind, Appellants assert that the Guetz and Zandi references, which

are clearly incompatible, fail to render the claimed subject matter obvious. Furthermore, the incompatibilities of the Guetz and Zandi references demonstrate that the Examiner has failed to present a *prima facie* case of obviousness, as addressed below.

Claim 36 is clearly patentable for the same reasons set forth above with respect to claim 2, and the arguments summarized there are herein incorporated by reference. In short, the Guetz reference clearly teaches the benefits of a lossy process, while Zandi teaches using lossy or lossless process. Further, the Zandi reference teaches a specific order that is inconsistent with the Guetz reference and even the order recited in the claims. As such, the two references cannot logically be combined. Furthermore, the Examiner's proposed combination is unsupported speculation and inconsistent with the teachings of the Guetz reference. Hence, the Guetz and Zandi references, which are clearly incompatible, fail to render the claimed subject matter obvious.

For at least these reasons, the Guetz and Zandi references cannot be properly combined to render the Appellants' claims obvious because the references are incompatible and the Examiner's rationale is unsupported by the references. Accordingly, Appellants request the Board overturn the rejection and allow the rejected claim 36 and its dependent claims.

8. <u>Claim 49 and its dependent claims are Patentable over Guetz and Zandi.</u>

Independent claim 49 recites:

> A computer program comprising:
> a machine readable medium for storing machine readable code; and
> configuration code stored on the machine readable medium, the code being configured to generate a plurality of data sets by decomposing image data using lossless wavelet decomposition, each data set corresponding to a resolution level, the code being further configured to losslessly compress the plurality of data sets and arrange the compressed plurality of data sets in order of increasing resolution levels.

In the rejection of independent claim 22, the Examiner relied upon assertions made in relation to independent claim 2 to formulate the basis of the rejection of independent claim 22. Again, as noted above, the Examiner admitted that the Guetz reference does not explicitly provide for lossless wavelet decomposition. Accordingly, in an attempt to cure this deficiency, the Examiner relied upon the Zandi reference.

However, despite the Examiner's assertions, the Guetz and Zandi references are incompatible with each other and fail to render the claimed subject matter obvious. In particular, claim 49 recites that the image data is *decomposed* into "a plurality of data sets" using lossless wavelet decomposition, each of the data sets are *losslessly compressed* and *arranged* "in order of increasing resolution levels." As a result, the lossless data stream is formed. With this in mind, Appellants assert that the Guetz and Zandi references, which are clearly incompatible, fail to render the claimed subject matter obvious. Furthermore, the incompatibilities of the Guetz and Zandi references demonstrate that the Examiner has failed to present a *prima facie* case of obviousness, as addressed below.

Claim 49 is clearly patentable for the same reasons set forth above with respect to claim 2, and the arguments summarized there are herein incorporated by reference. In short, the Guetz reference clearly teaches the benefits of a lossy process, while Zandi teaches using lossy or lossless process. Further, the Zandi reference teaches a specific order that is inconsistent with the Guetz reference and even the order recited in the claims. As such, the two references cannot logically be combined. Furthermore, the Examiner's proposed combination is unsupported speculation and inconsistent with the teachings of the Guetz reference. Hence, the Guetz and Zandi references, which are clearly incompatible, fail to render the claimed subject matter obvious.

For at least these reasons, the Guetz and Zandi references cannot be properly combined to render the Appellants' claims obvious because the references are incompatible and the Examiner's rationale is unsupported by the references.

Accordingly, Appellants request the Board overturn the rejection and allow the rejected claim 49 and its dependent claims.

B. **Ground of Rejection No. 2:**

The Examiner rejected claims 10, 25, 33, 47 and 53 under 35 U.S.C. § 103(a) as being unpatentable over Guetz in view of Zandi and Liang. Appellants respectfully traverse Examiner's rejection.

Claim10 depends from independent claim 2, claim 25 depends from independent claim 22, claim 33 depends from independent claim 30, claim 47 depends from independent claim 36, and claim 53 depends from independent claim 49. Appellants believe that claims 10, 25, 33, 47 and 53 are patentable based upon their dependency upon the respective independent claims along with their recited subject matter. In the rejection, the Examiner relied upon the Liang reference to disclose the claimed subject matter recited in claims 10, 25, 33, 47 and 53. However, the Liang reference is directed to a video compression and decoding system that utilizes embedded zerotree coding applied to a hierarchical decomposition with special wild card symbols. *See* Liang, col. 2, lines 61-67. In Liang, the reference teaches the use of quantization and the adjustment of the quantization threshold to adjust the reconstruction of the original frame, which is not a lossless process. *See* Liang, col. 7, lines 1-6. Further, Liang uses three-dimensional zerotree coding with eight filters to yield a hierarchical decomposition. *See* Liang, col. 7, line 64 – col. 8, line 10. The Liang reference fails to disclose or suggest all of the recited features of independent claims 2, 22, 30, 36 and 49, which are not disclosed by the Guetz and Zandi references. As a result, the Liang reference does not cure the Guetz and Zandi references. Therefore, the references, alone or in the proposed combination, fail to disclose or suggest all of the recited features. Accordingly, Appellants request that the Board overturn the rejection and indicate the allowability of the pending claims 10, 25, 33, 47 and 53.

C. **<u>Ground of Rejection No. 3</u>:**

The Examiner rejected claims 12 and 26 under 35 U.S.C. § 103(a) as being unpatentable over Guetz in view of Zandi and Zeng. Appellants respectfully traverse Examiner's rejection.

Claim12 depends from independent claim 2 and claim 26 depends from independent claim 22. Appellants believe claims 12 and 26 are patentable based upon their dependency upon the respective independent claims along with their recited subject matter. In the rejection, the Examiner relied upon the Zeng reference to disclose the claimed subject matter recited in claims 12 and 26. However, the Zeng reference is directed to compression of segmented images using multiple wavelet transformations. *See* Zeng, page 1, paragraph 0009. In Zeng, the wavelet decomposition is quantized in a fixed rate-matched quantizer step, which is a lossy process. *See* Zeng, page 3, paragraph 0030. Clearly, the Zeng reference fails to cure the Guetz and Zandi references because it also teaches the use of quantization. Therefore, the references, alone or in the proposed combination, fail to disclose or suggest all of the recited features. Accordingly, Appellants request that the Board overturn the rejection and indicate the allowability of the pending claims 12 and 26.

D. **<u>Ground of Rejection No. 1</u>:**

The Examiner rejected claims 37-44 under 35 U.S.C. § 103(a) as being unpatentable over Guetz in view of Zandi and Cooke. Appellants respectfully traverse Examiner's rejection.

Claims 37-44 depend from independent claim 36. Appellants believe claims 37-44 are patentable based upon their dependency upon independent claim along with their recited subject matter. In the rejection, the Examiner relied upon the Cooke reference to disclose the claimed subject matter recited in dependent claims 37-44. However, the Cooke reference is directed to a picture archival communications system (PACS) that includes routing, retrieval and display capabilities. *See* Cooke, col. 2, lines 13-32.

Clearly, the Cooke reference fails to cure the deficiencies of the Guetz and Zandi references. Therefore, the references, alone or in the proposed combination, fail to disclose or suggest all of the recited features. Accordingly, Appellants request that the Board overturn the rejection and indicate the allowability of the pending claims 37-44.

CONCLUSION

In view of the above remarks, Appellants respectfully submit that the Examiner has provided no supportable position or evidence that claims 2-55 are rendered obvious in view of the prior art. Accordingly, Appellants respectfully request that the Board find claims 2-55 patentable over the prior art of record and reverse all outstanding rejections.

General Authorization for Fees and Extensions of Time

The Commissioner is authorized to charge the requisite fee of $340.00, and any additional fees which may be required, to Account No. 50-2401, Order No. GEMS:0131/YOD; 15-IS-5887. Further, in accordance with 37 C.F.R. § 1.136, Appellants hereby provide a general authorization to treat this and any future reply requiring an extension of time as incorporating a request therefor. Furthermore, Appellants authorize the Commissioner to charge the appropriate fee for any extension of time to Deposit Account No. 50-2401, Order No. GEMS:0131/YOD; 15-IS-5887.

Respectfully submitted,

Date: November 9, 2004

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9. APPENDIX OF CLAIMS ON APPEAL

2. A method for compressing image data, the method comprising the acts of:

decomposing the image data into a plurality of data sets using lossless wavelet decomposition;

compressing the plurality of data sets using lossless compression; and

compiling a data stream comprising the compressed plurality of data sets arranged sequentially in a desired order based upon the decomposition.

3. The method of claim 2, wherein the lossless wavelet decomposition comprises lossless integer wavelet decomposition.

4. The method of claim 2, further comprising selectively transmitting at least a portion of the data stream, the portion being determined based upon user viewing capabilities.

5. The method of claim 2, wherein the data stream further comprises a header, the header comprising a quantity of the plurality of data sets, a resolution of each data set, and a compressed size of each data set.

6. The method of claim 2, wherein the desired order comprises an order of increasing resolution.

7. The method of claim 2, further comprising storing the data stream.

8. The method of claim 2, wherein the plurality of data sets correspond to a plurality of resolution levels.

9. The method of claim 2, wherein the act of decomposing the image data using lossless wavelet decomposition comprises creating a hierarchical set of sub-bands

comprising a low frequency component and high frequency components at a resolution level and further decomposing the low frequency component of the resolution level to form a next lower resolution level until a desired smallest resolution level is reached, each data set corresponding to a respective resolution level, each data set comprising a low frequency component and high frequency components at the respective resolution level.

10. The method of claim 9, wherein the act of compressing the plurality of data sets comprises compressing the high-frequency components using actual values and compressing the low frequency component at the desired smallest resolution level using prediction errors.

11. The method of claim 2, wherein the act of compressing the plurality of data sets comprises dividing the data sets into subregions to be individually compressed.

12. The method of claim 11, wherein the act of compressing the plurality of data sets further comprises selecting a compression algorithm for each subregion based upon an entropy of each subregion.

13. A method for retrieving compressed image data, the method comprising the acts of:

determining a parameter of a user view port;

selectively transmitting a portion of compressed image data based upon the parameter, wherein the compressed image data comprises a series of compressed data sets generated by lossless wavelet decomposition and compression, and wherein the series is ordered sequentially based upon order of generation of the data sets during lossless wavelet decomposition.

14. The method of claim 13, wherein the parameter of the user view port comprises a resolution level.

15. The method of claim 14, wherein the series of compressed data sets corresponds to a series of resolution levels.

16. The method of claim 15, wherein the act of selectively transmitting the portion of compressed image data based upon a parameter comprises transmitting the compressed data sets corresponding to resolution levels that are lower than or equal to the resolution of the user view port.

17. The method of claim 13, wherein the user view port comprises a workstation.

18. The method of claim 13, wherein the lossless wavelet decomposition comprises lossless integer wavelet decomposition.

19. The method of claim 13, wherein the series is ordered sequentially opposite the order of generation of the data sets during lossless wavelet decomposition.

20. The method of claim 13, wherein the act of determining a parameter of a user view port comprises acquiring a resolution from the client.

21. The method of claim 13, wherein the act of selectively transmitting comprises selectively transmitting over a network.

22. A method for handling image data, the method comprising the acts of:

decomposing the image data into a plurality of resolution levels using lossless wavelet decomposition;

compressing the decomposed image data from each resolution level using lossless compression; and

creating and storing a data stream in sets based upon the resolution levels of decomposed and compressed image data.

23. The method of claim 22, wherein lossless wavelet decomposition comprises lossless integer wavelet decomposition.

24. The method of claim 22, wherein the plurality of resolution levels comprises a lowest resolution level and a remaining plurality of resolution levels, and wherein the plurality of resolution levels each comprise high frequency components and a low frequency component.

25. The method of claim 24, wherein the act of compressing the decomposed image data comprises compressing the high frequency components using actual values and compressing the low frequency component of the lowest resolution level using prediction error values.

26. The method of claim 22, wherein the act of compressing the decomposed image data comprises dividing the decomposed image data into subregions and selecting a compression algorithm for each subregion based upon an entropy of that subregion.

27. The method of claim 22, further comprising the acts of selecting a resolution level of reconstruction based upon a viewing capacity of a client and reconstructing the image data to the selected resolution level.

28. The method of claim 22, further comprising accessing the sets of the data stream corresponding to resolution levels that are lower than or equal to a resolution of a user view port.

29. The method of claim 22, wherein the sets of the data stream are ordered sequentially in order of increasing resolution.

30. A method of storing image data, the method comprising the acts of:

decomposing the image data into a plurality of resolution levels using lossless integer wavelet decomposition;

compressing the decomposed image data based upon the plurality of resolution levels;

composing a file such that the decomposed and compressed image data is ordered sequentially by resolution level in order of increasing resolution; and

storing the file.

31. The method of claim 30, wherein the plurality of resolution levels comprises a lowest resolution level and a remaining plurality of resolution levels.

32. The method of claim 31, wherein the plurality of resolution levels each comprise high frequency components and a low frequency component.

33. The method of claim 32, wherein the act of compressing the decomposed image data comprises compressing the high frequency components based upon actual values and compressing the low frequency component of the lowest resolution level based upon prediction error values.

34. The method of claim 30, wherein the act of composing a file further comprises composing a header to be located before the decomposed and compressed image data, the header comprising a quantity of the plurality of resolution levels, a resolution of each resolution level, and a compressed size of compressed image data corresponding to each resolution level.

35. The method of claim 30, further comprising the act of selectively accessing the file based upon a parameter of a user view port.

36. A system comprising:

a compression interface, the interface being configured to decompose image data using lossless wavelet decomposition producing a plurality of data sets corresponding to a plurality of resolution levels comprising a lowest resolution level and a highest resolution level, being configured to losslessly compress the plurality of data sets, and being configured to arrange the compressed plurality of data sets into a data stream in order of increasing resolution from the lowest resolution level to the highest resolution level; and

a memory device configured to store the data stream.

37. The system of claim 36, wherein the system comprises a picture archiving and communication system.

38. The system of claim 37, further comprising one or more imaging systems.

39. The system of claim 38, wherein the one or more imaging systems comprise an MRI system.

40. The system of claim 38, wherein the one or more imaging systems comprise a computed tomography system.

41. The system of claim 38, wherein the one or more imaging systems comprise a positron emission tomography system.

42. The system of claim 38, wherein the one or more imaging systems comprise a radio fluoroscopy system.

43. The system of claim 38, wherein the one or more imaging systems comprise a computed radiography system.

44. The system of claim 38, wherein the one or more imaging systems comprise an ultrasound system.

45. The system of claim 36, wherein the lossless wavelet decomposition comprises lossless integer wavelet decomposition.

46. The system of claim 36, wherein the plurality of data sets comprise a lowest resolution data set and a remaining plurality of data sets, the remaining plurality of data sets and the lowest resolution data set each comprising high frequency components and a low frequency component.

47. The system of claim 46, wherein the compression interface is configured to losslessly compress the high frequency components using actual values and the low frequency component using prediction error values.

48. The system of claim 36, further comprising an output interface configured to selectively access a portion of the data stream, the portion corresponding to a resolution of a client.

49. A computer program comprising:

a machine readable medium for storing machine readable code; and

configuration code stored on the machine readable medium, the code being configured to generate a plurality of data sets by decomposing image data using lossless wavelet decomposition, each data set corresponding to a resolution level, the code being further configured to losslessly compress the plurality of data sets and arrange the compressed plurality of data sets in order of increasing resolution levels.

50. The computer program of claim 49, wherein the code is further configured to selectively access a portion of the plurality of data sets, the portion corresponding to a resolution level of a viewing client.

51. The computer program of claim 49, wherein the lossless wavelet decomposition comprises lossless integer wavelet decomposition.

52. The computer program of claim 49, wherein the plurality of data sets comprise a lowest resolution data set and a remaining plurality of data sets and wherein the plurality of data sets each comprise high frequency components and a low frequency component.

53. The computer program of claim 52, wherein the code is configured to losslessly compress the high frequency components using actual values and the low frequency component of the lowest resolution data set using prediction error values.

54. The computer program of claim 49, wherein the code is further configured to store the arranged compressed plurality of data sets in a file.

55. The computer program of claim 54, wherein the file comprises a header, the header comprising a quantity of the plurality of data sets, a resolution of each data set, and a compressed size of each data set.